



Relationship of Lemon Score with Prediction of Difficulty Intubation in General Anesthesia Patients

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CROSS-SECTIONAL STUDY

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Abstract

Background: General anesthesia is the most widely practiced anesthetic technique, and mishandling of the airway may lead to serious and even life-threatening complications. Intubation success is maximized when the LEMON assessment is applied to cases where the anesthesia assessment also assesses for prediction of intubation difficulty. **Purpose:** This study aims to find out the relationship between the LEMON scoring and the prediction of intubation difficulty encountered during general anesthesia. **Methods:** This quantitative study follows a cross-sectional design with data being collected within one single period. The sample consisted of 52 individuals undergoing general anesthesia with endotracheal intubation (ETT). Chi-square testing was performed with Fisher's Exact Test as the alternative for statistical analysis. **Results:** The analysis yielded a p-value of 0.019, which is below the 0.05 cutoff, demonstrating a significant association between the LEMON score and the prediction of intubation difficulty in patients undergoing general anesthesia at RSUD Dr. Soedirman Kebumen. **Conclusions:** A statistically significant association was found between the LEMON score and the prediction of intubation difficulty. The implication is that LEMON scoring can be another useful tool for anesthetic pre-evaluation in predicting probable airway management concerns during general anesthesia in patient

Keywords: airway management; intubation, endotracheal; general anesthesia; lemon score

Introduction

General anesthesia is the most commonly used anesthesia technique compared to other anesthesia techniques. As many as 70 to 80 percent of surgical cases require general anesthesia [1]. According to data from LSI (Indonesian Survey Circle), the number of anesthesia use in Indonesia is 4.67 million patients [2]. Maintaining the airway is very important during anesthesia [3,4]. Endotracheal intubation is the act of inserting an endotracheal tube into the patient's airway to ensure the supply of anesthetic gas so that surgery can be performed [5].

The intubation difficulty rate in patients undergoing surgery under general anesthesia ranges from 1.5% to 13%. As intubation failure can lead to serious problems such as hypoventilation, hypoxemia, cell damage, brain damage, and death, preoperative screening to detect difficulties related to maintaining airway potential is essential [6]. According to RISKESNAS, intubation difficulties in general anesthesia in Indonesia ranged from 2% to 5% in the last 5 years 2018-2023.

The standard method for assessing intubation difficulty is the LEMON examination, the LEMON examination is

the initial examination to determine intubation difficulty [7]. Difficulties in surgery can be found in several factors such as obesity, large tongue, and so on [8,9]. So that an assessment is needed to be able to overcome the incidence of failed intubation. Intubation success can be improved by applying the LEMON assessment in pre-anesthesia so that it can help predict the possibility of difficult intubation [10].

According to the results of research by Tripathi et al., (2019) External found the most is a toothless mouth with an incidence of 26.87%. Evaluate the most difficulty level is 2-3-2. Mallampati class as much as 56.71% in class I, 39.39% in class II. In the LEMON Obstruction component, 98.51% had no obstruction[11–13]. Neck Mobility we found that 85.1% of subjects had neck mobility and only 15.15% of subjects had limited neck mobility. We observed that the LEMON score was 60% sensitive and 96.15% specific for predicting airway difficulty [13–15]. The positive predictive value was 83.33%.

Based on a pre-survey conducted at dr. Soedirman Hospital, it was found that the number of patients with ETT general anesthesia at dr. Soedirman Hospital Kebumen in September was 30 patients. Based on interviews with nurses in charge of IBS, it was found that the incidence of difficult intubation in dr. soedirman Kebumen Hospital was still quite high. This is evidenced by the data that 3 out of 10 patients (30%) who underwent surgery with general anesthesia with intubation difficulties.

Based on this background, the author is interested in conducting research with the title "the relationship between LEMON score and the prediction of intubation difficulties in general anesthesia patients at Dr. Soedirman Kebumen Hospital".

Methods

This research is quantitative, with a cross-sectional design (at one point in time) during one data collection period. With a sample of 52 respondents who underwent general anesthesia using ETT. Using chi square with alternative fisher's exact test.

This study was conducted in July 2024 consisting of 3 stages, namely preparation, implementation and preparation of reports and data collection was carried out on May 28 to June 30, 2024 at RSUD Dr. Soedirman Kebumen.

The population in this study were all patients who underwent surgery with general anesthesia using ETT at RSUD dr. Soedirman Kebumen. The average number of ETT general anesthesia patients every 2 months at RSUD dr. Soediman Kebumen was 60 patients.

The sample of this study was taken from all patients who underwent ETT general anesthesia at RSUD dr. Soedirman Kebumen who met certain characteristics. The University of California, Berkeley's Research Ethics Committee gave its stamp of approval to this study (B.L.PPM-UHB/391/05/2024).

Result

1. Respondents characteristics

Table 4.1: Frequency distribution and characteristics of respondents based on gender, ASA, age and type of surgery (n=52)

Characteristics	Frequency (n)	Percentage (%)
Age		
Teenagers (17-25)	10	19.2
Early Adult (26-35)	8	15.4
Late Adult (36-45)	7	13.5
Early Elderly (46-55)	7	13.5
Late Eldery (56-65)	9	17.3
Elderly (>65)	11	21.2
Gender		

Male	26	50
Female	26	50
ASA		
ASA 1	0	0
ASA 2	51	100
Operation		
Type		
General	28	53.8
Surgery		
Orthopedic	9	17.3
Surgery		
Oncology	9	17.3
Surgical		
Urology	6	11.5
Surgery		
Total	52	100

Source: Primary data 2024

Based on table 4.1, the results show that most respondents are based on age > 65 years as many as 11 respondents (21.2%) and as many as 7 respondents aged 36-45 years. Female gender as many as 26 respondents (50.0%) and for those who are male as many as 26 respondents (50.0%). Based on the American Society of Anesthesiologist (ASA) or the patient's physical status found ASA 2 as many as 52 respondents (100%). Based on the type of surgery, general surgery was 28 respondents (53.8%) and a small proportion of 6 respondents were urological surgery.

2. Univariate Analysis

Table 4. 2 Frequency distribution and characteristics of respondents Predicted intubation difficulty and Intubation difficulty (n=52)

Variables	Total (n)	Percentage (%)
Intubation Difficulty Prediction		
1. Easy prediction LEMON score (0-5)	51	98.1
2. Hard prediction LEMON score (6-10)	1	1.9
Total	52	100

Intubation difficulty		
1. Easy intubation (<60 seconds)	51	98.1
2. Difficulty intubation (60 seconds)	1	1.9
Total	52	100

Source: Primary data 2024

Based on table 4.2, the results of predicting the difficulty of intubation for patients with easy prediction of LEMON Score (0-5) were 51 respondents (98.1%), prediction of difficult ILEMON Score (6-10) was 1 respondent (1.9%). The results of intubation difficulty with easy intubation were 51 respondents (98.1%), difficult intubation was 1 respondent (1.9%).

Table 4. 3 Frequency distribution and characteristics of LEMON score (n=52)

Characteristics	Frequency (n)	Percentage (%)
<i>Look externally</i>		
1. Normal	22	39.29
2. Facial trauma	0	0
3. Large incisors	10	17.86
4. Beard mustache	20	35.71
5. Large tongue	4	7.14
<i>Evaluate 3-3-2</i>		
1. Normal	51	96.23
2. Interincisor distance <2 (fingers)	1	1.89
3. Distance from mentum to hyoid <2 (fingers)	1	1.89
4. Distance from hyoid to thyroid <1 (fingers)	0	0
<i>Mallampati</i>		
1. Grades 1 and 2	45	86.54
2. Grades 3 and 4	7	13.46

<i>Obstruction</i>			
1.	Normal	26	50
2.	Broken tooth foreign banda etc	26	50
<i>Neck mobility</i>			
1.	Free	47	90.38
2.	Caused by a cause	5	19.62

Source: Primary data 2024

Based on table 4.3 get the results Look externally more dominant norm value 22 respondents 39.29%, Evaluate 3-3-2 mostly normal value 51 respondents 96.23%, Mallampati mostly grade 1 and 2 as much as 45 respondents 86.54%, Obstruction norm value as much as 26 respondents 50% and value Broken teeth / foreign landmarks etc. as much as 26 respondents 50%, Neck mobility free value as much as 49 respondents 94.2%

3. Bivariate Analysis

Table 4.4 Relationship between LEMON Score and Predicted Intubation Difficulty

		Intubation difficulty				Contin gency coeffic ient	<i>P</i> <i>val</i> <i>ue</i>
		Easy intuba tion		Diffic ult intuba tion			
		n	%	n	%		
LE MO N scor e	Predi ction easy (0-5)	5 1	98 .1	0	0		
	Predi ction diffic ult (6- 10)	0	0	1	1. 9		

Source: Primary data 2024

Based on the results of data analysis in table 4.4, the results obtained are the correlation value that has been carried out by respondents between the 2 variables LEMON score and intubation difficulty produces a value of 0.707 which means a

strong relationship. The results of the alternative test value of fisher's exact test, it is known that the p-value is 0.019 while the fisher's alternative test requirement must be (p-value <0.05) from this value indicates that there is a significant relationship between LEMON Score and Intubation Difficulty in General anesthesia patients at RSUD dr. Soedirman Kebumen.

Discussions

Characteristics of respondents

Based on table 4.1, it is obtained that the percentage based on female gender is 26 respondents (50.0%) and for those who are male as many as 26 respondents (50.0%). According to Norlailiyah's research (2023), which examined the "Relationship between ERGI score and Prediction of Intubation Success in General Anesthesia Patients" showed that most of the respondents were female, namely 48 respondents (51.1%) and then followed by men as many as 46 respondents (48.9%) [5]. According to research by Tiar et al., (2022) "Factors Associated with Patient Compliance with Hemodialysis at Saiful Anwar Malang Hospital" Female: 50% (50 respondents), Male: 50% (50 respondents) [16]. According to the researcher's assumption, the number of men and women is balanced because the researcher wants to know more specifically about this research with a balanced number of genders [8,12].

Based on table 4.1, the American Society of Anesthesiologist (ASA) or the physical status of the patient was found to be ASA 2 as many as 52 respondents (100%). This is in line with the research of Asta et al. (2023) "Analysis of Factors Associated with the Incidence of Pain After Caesarean Section Surgery" the proportion of ASA 2 respondents was 100% (20 respondents) [17]. According to research (ŞENGEL et al., 2022), participants based on ASA status were mostly group D, ASA 2 (33.33%). According to the results of

Zamali's research, (2022) "The Relationship between ASA Physical Status and the Incidence of Postoperative Pain in Acute Appendicitis Patients" the proportion of ASA 2 respondents was 100% (24 respondents). Based on the researcher's analysis, this may be due to the respondent's medical condition. patients with ASA 2 status can provide informed consent because they are generally healthier and have less risk of complications. According to the researcher's assumption, ASA 2 is dominant at RSUD Dr. Soedirman Kebumen because each patient has a history of controlled disease [18].

Based on table 4.1 the value obtained is the dominant age > 65 years as many as 11 respondents (21.2%). The results of this study are in line with research conducted by (Moon et al., 2013) age > 65 is more dominant as many as 89 respondents. According to the assumption of researchers, patients aged > 65 years have the risk of several chronic medical conditions where one of the actions requires surgery. As age increases, head and neck movement, thyromental distance, and interincisor gap decrease, tooth growth rate, mallampati score, cervical joint stiffness decreases. In the old and middle groups, the incidence of difficult intubation increases compared to the easy group [19].

Based on table 4.1, the value of the type of general surgery operation is dominant as many as 28 respondents (53.8%). These results are in line with (Norlailiyah et al., 2023), who obtained the results of the type of operation mostly in general surgery, namely 40 respondents (42.6%). According to the researcher's assumption at RSUD Dr. Soedirman Kebumen, the characteristics of the respondents were mostly general surgery.

LEMON Score in General Anesthesia patients at RSUD Dr. Soedirman Kebumen.

Based on table 4.3, the results of the study obtained an assessment of look externally more dominant normal value 23 respondents 44.2%. Evaluate 3-3-2 mostly normal values 51 respondents 98.1%, Mallampati mostly grade 1 and 2 as many as 46 respondents 88.5%, Obstruction normal value as many as 26 respondents 50% and value Broken teeth / foreign marks etc. as many as 26 respondents 50%, Neck mobility free value as many as 49 respondents 94.2%.

Based on table 4.4, almost all respondents were classified as easy intubation predictions as many as 51 respondents (98.1%) with easy intubation results and respondents with difficult intubation predictions as many as 1 respondent (1.9%). This is in line with research [3,14], which obtained the results of easy intubation prediction as many as 93 respondents (98.9%) and prediction of difficult intubation as many as 1 respondent (1.1%). This study is also in line with the results of research by [9,11], which showed the results of 15.6% of patients were difficult intubation and 84.4% were easy to intubate. According to the researcher's assumption, this happened because of the LEMON Score assessment component, namely: Look, Evaluate, Mallampati, Obstruction, Neck [20].

Intubation difficulties in general anesthesia patients at RSUD dr. Soedirman Kebumen

Based on research that has been carried out so as to get patients with general anesthesia intubation difficult intubation with the results, namely easy intubation as many as 51 respondents (98.1%) and difficult intubation as many as 1 respondent (9.1%), in these results it was found that the majority of respondents experienced easy intubation. This is in line with research which obtained the results of successful intubation as many as 93 respondents

(98.9%) and those who failed intubation as many as 1 respondent (1.1%). According to the researcher's assumption, the ease of intubation is by conducting a LEMON examination during pre-anesthesia. This is in line with which states that one of the successes of intubation is to prepare the patient properly and maximally by assessing the airway so as to predict the success of intubation, in his research the results were obtained as many as 104 respondents were successfully intubated as many as 104 respondents (100%). Other factors indicating the smoothness of an intubation action are the height of the operating table, the position of the patient's head, the sniffing position, the induction pillow, the operating table, and sellick maneuver [21].

The success of intubation in this study uses the assessment of intubation time where if successful intubation is stated with less than 60 seconds and if more than 60 seconds is said to be difficult intubation. Respiratory vital capacity can last for 60 seconds after 100% preoxygenation for 3-5 minutes, the time is calculated when ventilation is stopped and the blade of the laryngoscope enters and ends when ventilation is given again. Respondents who failed to undergo intubation in this study were one respondent (1.1%) [22].

Relationship between LEMON Score and prediction of intubation difficulty

Based on the results of hypothesis testing using the Fisherr's exact test, the p value of 0.019 (p value <0.05) indicates that there is a significant relationship between LEMON Score and Prediction of Intubation Difficulties in General Anesthesia Patients at RSUD Dr. Soedirman Kebumen. This study is not in line with research (Norlailiyah et al., 2023) which obtained the results of the fisher's exact test, known p-value 0.011 (p-value <0.05) which shows that there is a significant relationship

between EGRI Score and Intubation Success in General Patients at Klungkung Regency Hospital. These results are in line with Darmanto's 2017 research, conducted at Dr. Soetomo Hospital, which said that one of the things that helps the success of intubation is full and maximum patient preparation by conducting an airway assessment to predict the success of tracheal intubation [4,15]. In his research, the results obtained by 104 respondents were successful intubation 104 respondents (100%).

According to research by Tripathi et al., (2019), LEMON Score can reduce the likelihood of difficult intubation. This is evident from the results of the examination "look externally" the most common finding is a toothless mouth with an incidence of 26.87%. In the 'Evaluate' component, the most common difficulty level was 2-3-2. In Mallampati class 56.71% were class I, 39.39% were class II. In the Obstruction LEMON component, 98.51% had no obstacles. In the Neck Mobility component we found that 85.1% of the subjects had neck mobility and only 15.15% of the subjects had limited neck mobility. We observed that the LEMON score was 60% sensitive and 96.15% specific for predicting airway difficulty [23].

According to the researcher's assumption, the LEMON score has a relationship with the prediction of intubation difficulty because it is evident from previous research, namely the study entitled "Determination of Intubation Difficulty in IGD" getting the results of the LEMON score is strongly associated with difficult intubation.

Conclusion

By conservative assessment of the results and discussions conducted at the Central Surgical Installation of RSUD Dr. Soedirman Kebumen, it can be highlighted that a majority of respondents were people

above 65 years. Male and female respondents in this study are almost equal with respect to numbers. All respondents were defined as ASA 2 according to the level of physical status defined by the American Society of Anesthesiologists; most of them underwent surgery generally. In the majority of general anesthesia cases at RSUD Dr. Soedirman Kebumen, the LEMON score mainly predicted simple intubation in most cases among the criteria for easy intubation. Most intubations carried out were easy and therefore corroborated the efficacy of the LEMON score in predicting intubation difficulty. With a significant relationship between the LEMON scoring mechanism and prediction of difficult intubation, the study revealed a p-value of apparent statistical significance too. Limitations of this study include refusal by some respondents to documentation which caused difficulties in data gathering and also restricted time for the investigation of the success of intubation due to concurrent responsibilities in another operating theatre, therefore calling for assistance from either anesthesiologists or colleagues on duty.

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Conflict of Interest Statement

The authors have confirmed that they have no competing interests.

Data Availability

The datasets used or generated in this study are available from the corresponding author upon reasonable request.

Author Contributions

Rista: Conception and design of the study, Search Data Base, Methodology, Analysis Risk of Bias, Data Analysis and Interpretation, Writing, Review, and Editing. **Danang Tri Yudono:** Study conception and design, search database, methodology, data analysis, and interpretation, and writing, review, and editing. **Made Suandika:** Conception and design of the study, Search Database, Methodology, Data Analysis, and Interpretation, Writing, Review, and Editing.

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